CLAIMS

1. A displacement detector comprising:

a constant-current supply unit configured to output a constant current including an alternating current;

a coil portion, to which the constant current is supplied;

a magnetic core supported to be movable relative to said coil portion in a movable range; and

a signal processing circuit configured to determine a displacement of said core to said coil portion in accordance with a change in output voltage of said coil portion under a condition of supplying the constant current to said coil portion;

wherein said constant-current supply unit supplies the constant current, which is obtained by superimposing a direct current on the alternating current, to said coil portion, and a fluctuation width of temperature coefficient of a peak value of the output voltage of said coil portion, which is a total of DC and AC voltage components, in said movable range is smaller than the fluctuation width of temperature coefficient of the AC voltage component in said movable range.

2. The displacement detector as set forth in claim 1, wherein at least one of a ratio between the alternating current and a direct current in the constant current, a ratio between AC and DC components of an impedance of said coil portion, a temperature characteristic of the ratio between the alternating current and the direct current in the constant current, and a temperature characteristic of the ratio between the AC and DC components of the impedance of said coil portion is determined such that the fluctuation width of temperature coefficient of said peak value is smaller than the fluctuation width of temperature coefficient of the AC voltage component.

3. The displacement detector as set forth in claim 1, wherein said coil portion comprises a curved coil having a curvature, said core has the same curvature as said curved coil, and is rotatable about a rotation axis, and an insertion amount of said core into said curved coil is changed by rotating said core about the rotation axis.

4. The displacement detector as set forth in claim 3, wherein the temperature coefficient of the DC voltage component of the output voltage of said coil portion is closer to the temperature coefficient of the AC voltage component of the output voltage of said coil portion in the case of a maximum insertion amount of said core into said curved coil than the temperature coefficient of the AC voltage component of the output voltage of said coil portion in the case of a minimum insertion amount of said core into said curved coil.

5. The displacement detector as set forth in claim 1, wherein said constant-current supply unit comprises an oscillating circuit configured to generate a voltage obtained by superimposing a DC voltage on an AC voltage, and a voltage/current conversion circuit, and a ratio between the AC and DC voltages in said voltage is determined such that the fluctuation width of the temperature coefficient of said peak value is smaller than the fluctuation width of the temperature coefficient of the AC voltage component.

6. The displacement detector as set forth in claim 1, wherein said constant-current supply unit comprises an oscillating circuit configured to generate a voltage obtained by superimposing a DC voltage on an AC voltage, and a voltage/current conversion circuit, said oscillating circuit has a

resistance, by which a value of the DC voltage is determined, and the temperature coefficient of a value of said resistance is determined such that the fluctuation width of the temperature coefficient of said peak value is smaller than the fluctuation width of the temperature coefficient of the AC voltage component.

7. The displacement detector as set forth in claim 1, wherein said constant-current supply unit comprises an oscillating circuit configured to generate a voltage obtained by superimposing a DC voltage on an AC voltage, and a voltage/current conversion circuit, and a temperature characteristic of frequency of the AC voltage is determined such that the fluctuation width of the temperature coefficient of said peak value is smaller than the fluctuation width of the temperature coefficient of the AC voltage component.

8. The displacement detector as set forth in claim 1, wherein said constant-current supply unit comprises a DC constant-current circuit and an AC constant-current circuit, at least one of a temperature characteristic of a value of direct current provided from said DC constant-current circuit, a temperature characteristic of frequency of an alternating current provided from said AC constant-current circuit, and a temperature characteristic of a value of the alternating current provided from said AC constant-current circuit is determined such that the fluctuation width of the temperature coefficient of said peak value is smaller than the fluctuation width of the temperature coefficient of the AC voltage component.

9. The displacement detector as set forth in claim 1, wherein said coil portion comprises a coil and a circuit element connected in series with said coil and

having no dependency of impedance on displacement of said core, and at least one of DC and AC components of the impedance of said circuit element, and temperature coefficients of the DC and AC components of the impedance of said circuit element is determined such that the fluctuation width of the temperature coefficient of said peak value is smaller than the fluctuation width of the temperature coefficient of the AC voltage component.

10. The displacement detector as set forth in claim 9, wherein said circuit element is one of a resistance and an inductor.

11. The displacement detector as set forth in claim 1, wherein said constant-current supply unit is provided by an integrated circuit comprising resistances setting a magnitude of a direct current, frequency and amplitude of an alternating current, and digital trimming unit configured to set values of said resistances, and the values of said resistances are determined by said digital trimming unit such that the fluctuation width of the temperature coefficient of said peak value is smaller than the fluctuation width of the temperature coefficient of the AC voltage component.

12. The displacement detector as set forth in claim 1, wherein said signal processing circuit comprises a rectifying circuit and a circuit configured to peak-hold an output of said rectifying circuit.

13. The displacement detector as set forth in claim 1, wherein said signal processing circuit has an amplifier with a temperature coefficient that is in a reverse polarity relation with the temperature coefficient of said peak value of

the output voltage of said coil portion, and said signal processing circuit outputs a displacement signal indicative of position data of said core relative to said coil portion in accordance with an output of said amplifier.

14. The displacement detector as set forth in claim 5, wherein the AC voltage generated by said oscillating circuit is a triangular wave.

15. The displacement detector as set forth in claim 3, wherein said coil portion has a curved coil having a curvature, and said curved coil is fixed to a housing having a unit configured to correct a change in curvature of said curved coil.

16. The displacement detector as set forth in claim 1, wherein said core is provided by a plurality of curved cores having a same curvature, which are supported to be rotatable about a single rotation axis,
said coil portion comprises a plurality of coils having a same curvature as said curved cores, which are spaced from each other in the axial direction of the rotation axis, and
insertion amounts of said curved cores into said coils are changed by rotating said curved cores about the rotation axis.

17. The displacement detector as set forth in claim 1, wherein said coil portion is provided by a pair of inner and outer coils having different curvatures, which are disposed to be curved in substantially parallel with each other,
said core comprises a first core curved at a same curvature as said inner core and supported to be rotatable about a rotation axis, and a second core curved at a same curvature as said outer core and supported to be rotatable about the

rotation axis,

an insertion amount of said first core into said inner core is changed by rotating said first core about the rotation axis, and

an insertion amount of said second core into said outer core is changed by rotating said second core about the rotation axis.

18. The displacement detector as set forth in claim 1, wherein said signal processing circuit comprises a signal compensation circuit composed of an A/D conversion circuit configured to convert the peak value of the output voltage of said coil portion into a digital signal, and a compensation circuit configured to perform digital trimming to said digital signal.

19. A displacement detector comprising:

a constant-current supply unit configured to output a constant current including an alternating current;

a coil portion, to which the constant current is supplied;

a magnetic core supported to be movable relative to said coil portion in a movable range; and

a signal processing circuit configured to determine a displacement of said core to said coil portion in accordance with a change in output voltage of said coil portion under a condition of supplying the constant current to said coil portion;

wherein the displacement detector further comprises a characteristic-value extracting unit configured to extract a characteristic value from the output voltage of said coil portion, and a level shift circuit configured to add a level shift voltage to the characteristic value, and

wherein a fluctuation width of temperature coefficient of a total of the characteristic value and the level shift voltage in said movable range is smaller than the fluctuation width of temperature coefficient of the characteristic value

in said movable range.

20. The displacement detector as set forth in claim 19, further comprising a unit configured to adjust at least one of a temperature coefficient and a magnitude of the level shift voltage.

21. The displacement detector as set forth in claim 19, wherein said signal processing circuit comprises a peak-hold circuit as said characteristic-value extracting unit, A/D conversion circuit configured to convert the characteristic value into a digital signal, which is disposed between said peak-hold circuit and said level shift circuit, and a temperature compensation circuit configured to perform a temperature compensation to an output of said level shift circuit.

22. The displacement detector as set forth in claim 19, wherein the characteristic value is one of a peak value of the output voltage of said coil portion, bottom value of the output voltage of said coil portion, and a value proportional to an amplitude of the output voltage of said coil portion.

23. The displacement detector as set forth in claim 19, wherein said coil portion comprises a curved coil having a curvature,
said core has a same curvature as said curved coil, and is rotatable about a rotation axis, and
an insertion amount of said core into said curved coil is changed by rotating said core about the rotation axis.

24. The displacement detector as set forth in claim 19, wherein said coil portion has a curved coil having a curvature, and said curved coil is fixed to a housing having a unit configured to adjust a change in curvature of said curved coil.

25. The displacement detector as set forth in claim 19, wherein said core is provided by a plurality of curved cores having a same curvature, which are supported to be rotatable about a single rotation axis,
said coil portion comprises a plurality of coils having a same curvature as said curved cores, which are spaced from each other in the axial direction of the rotation axis, and
insertion amounts of said curved cores into said coils are changed by rotating said curved cores about the rotation axis.

26. The displacement detector as set forth in claim 19, wherein said coil portion is provided by a pair of inner and outer coils having different curvatures, which are disposed to be curved in substantially parallel with each other,
said core comprises a first core curved at a same curvature as said inner core and supported to be rotatable about a rotation axis, and a second core curved at a same curvature as said outer core and supported to be rotatable about the rotation axis,
an insertion amount of said first core into said inner core is changed by rotating said first core about the rotation axis, and
an insertion amount of said second core into said outer core is changed by rotating said second core about the rotation axis.

27. The displacement detector as set forth in claim 19, wherein said signal processing circuit comprises a signal compensation circuit composed of an A/D

conversion circuit configured to convert a peak value of the output voltage of said coil portion into a digital signal, and a compensation circuit configured for digital trimming said digital signal.

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